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Preface

Developments in language theory

This special issue contains the full versions of 11 papers presented at the Tenth International Conference: Developments in Language Theory (DLT 2006), held in Santa Barbara, California, USA, on June 26–29, 2006. The conference series provides a forum for recent developments in formal languages. Its scope includes the following topics: grammars, acceptors and transducers for strings, trees, graphs, arrays; efficient text algorithms; algebraic theories for automata and languages; combinatorial and algebraic properties of words and languages; variable-length codes; symbolic dynamics; decision problems; relations to complexity theory and logic; picture description and analysis; polyominoes and bidimensional patterns; cryptography; concurrency; bio-inspired computing; quantum computing.

The first two articles are expanded versions of two invited presentations at the conference.

The paper by Andrzej Ehrenfeucht and Grzegorz Rozenberg deals with reaction systems which are formal models of interactions between biochemical reactions. It introduces the notion of a module, and then investigates the formation and evolution of modules.

The paper by Yuri Gurevich, Margus Veanes and Charles Wallace discusses the abstract state machine (ASM) as a modern computation model. ASMs and ASM based tools are used in academia and industry, albeit on a modest scale. They allow one to give high-level operational semantics to computer artifacts and to write executable specifications of software and hardware at the desired abstraction level. The authors point out several ways abstract state machines can be useful to the DLT community.

Dmitry Ananichev, Mikhail Volkov and Yu I. Zaks present two infinite series of synchronizing automata with a letter of deficiency 2 whose shortest reset words are longer than those for synchronizing automata obtained by a straightforward modification of Cerny's construction.

The paper by Cedric Bastien, Jurek Czyzowicz, Wojciech Fraczak and Wojciech Rytter presents an efficient algorithm for testing the equivalence of simple functions. Such functions correspond to one-state deterministic pushdown transducers. Their algorithm works in time polynomial with respect to $|G| + v(G)$, where $|G|$ is the size of the textual description of G, and $v(G)$ is the maximum of the shortest lengths of words generated by nonterminals of G.

In his paper, Olivier Carton introduces alpha-synchronous relations for a rational number alpha and shows that if a rational relation is both alpha- and alpha$'$-synchronous for two different numbers alpha and alpha$'$, then it is recognizable. He gives a synchronization algorithm for alpha-synchronous transducers and also proves the closure under boolean operations and composition of alpha-synchronous relations.

The paper by Yo-Sub Han, Arto Salomaa, Kai Salomaa, Derick Wood and Sheng Yu gives a decidable characterization of strongly prime decomposable regular languages and, using the characterization, shows that every regular language over a unary alphabet has a prime decomposition. They also briefly consider infinite factorizations of unary languages.

Dalia Krieger characterizes and shows how to compute critical exponents of infinite words generated by iterating a non-erasing morphism over an alphabet of size t. Such critical exponents, if finite, are rational when the generating morphism is uniform, and algebraic of degree at most t otherwise.

The next paper, by Manfred Kufleitner, shows that some language theoretic and logical characterizations of recognizable word languages whose syntactic monoid is in the variety DA also hold over traces. To this end he

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gives algebraic characterizations for the language operations of generating the polynomial closure and generating the unambiguous polynomial closure over traces. Further, he shows that there exist natural fragments of local temporal logic that describe this class of languages corresponding to DA.

Martin Kutrib and Andreas Malcher investigate pushdown automata using limited and unlimited amounts of nondeterminism that allow nondeterministic steps only within certain contexts, i.e., in configurations that meet particular conditions. They study the relationships of the accepted language families with closures of the deterministic context-free languages under regular operations as well as closure properties.

Alexander Okhotin and Oksana Yakimova consider systems of language equations with concatenation and complementation as the only operations. They obtain mathematical characterizations of solution existence and of solution uniqueness, and determine the computational complexity of testing these properties. They leave open the decidability of uniqueness in the most general case.

Finally, in his paper, Bala Ravikumar considers several variations of probabilistic finite automata models and presents some results regarding the languages that can or cannot be recognized by these devices.

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